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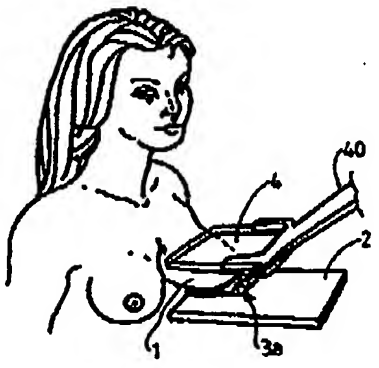
(54) Procédé d'amélioration de la qualité des clichés radiologiques et dispositif permettant la mise en œuvre du procédé.

(57) La présente invention concerne un procédé d'amélioration de la qualité des clichés radiologiques et le dispositif permettant la mise en œuvre du procédé.

Le procédé d'amélioration de la qualité des clichés radiologiques est caractérisé en ce qu'il consiste à interposer sur le trajet du rayonnement entre la cible (1) et le film sensible aux rayons X, ou entre le tube et la cible une poche (3) en matériau déformable, remplie partiellement sous vide par un fluide ou un gel.



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PROCESS FOR IMPROVING THE QUALITY OF X-RAY IMAGES AND DEVICE FOR IMPLEMENTING SAID PROCESS

This invention pertains to a process for improving the quality of x-ray images and the corresponding device.

With current x-ray techniques, the images obtained of parts of the body having a variable thickness show under- and overexposed areas. These phenomena occur, for instance, in x-rays of a finger in the peripheral areas, in the shoulder or spinal column, particularly in the lumbar or cervical areas, or in mammographies in the cutaneous and subcutaneous areas.

Attempts have been made to overcome these drawbacks using various techniques, such as by using filter cones or grids to decrease the scattering of radiation. In spite of these improvements, thin areas are still overexposed.

The first purpose of this invention is therefore to propose a process for improving the quality of x-ray images.

This purpose is served by the process of the invention, which consists in placing a bag of distortable material, partially filled with a fluid or gel under vacuum conditions, between the target and x-ray sensitive film, or between the tube and target, along the radiation path.

According to another feature, the process consists in exerting pressure on the target and the bag so as to distort the bag.

According to another feature, the bag is unattached and placed on the film tray of an x-ray device or beneath the pressure plate.

According to another feature, the bag is secured to one side of the film tray of the x-ray device or one side of the pressure plate.

According to another feature, the fluid is water.

According to another feature, the volume of fluid or gel partially filling the bag is between one fourth and one half of the maximum permissible volume.

According to another feature, the volume of fluid or gel partially filling the bag is preferably between one fourth and one third of the maximum permissible volume.

According to another feature, the fluid or gel filling the bag has a viscosity of between 10,000 and 100,000 centipoises.

According to another feature, the bag is attached at its ends.

Another purpose of the invention is to propose a device making it possible to improve the quality of x-ray images.

This purpose is served by the fact that the device has at least one bag made of distortable material partially filled in a vacuum with a gel or fluid, which is placed between the target and x-ray sensitive film, or between the tube and target, along the path of radiation generated by an x-ray source.

According to another feature, the unattached bag is placed on the film tray of the x-ray device or beneath the pressure plate.

According to another feature, the bag is secured to one side of the film tray.

According to another feature, the fluid is water.

According to another feature, the volume of fluid partially filling the bag is between one fourth and one half of the maximum permissible volume.

According to another feature, a second bag is placed between the radiation source and the target, with said second bag being associated with devices making it possible to apply this second bag to the target with a specific amount of pressure.

According to another feature, this second bag is partially filled with air.

Other characteristics and benefits of this invention will become clear from a reading of the following description given in reference to the appended drawings, in which:

- Figure 1 is a perspective drawing of the device according to the invention for implementing the process;
- Figure 2 is a top view of the bag enabling implementation of the process;
- Figure 3 is a partial cross-sectional view of the bag on the film tray;
- Figure 4 shows a partial cross-section of another variant of the bag on the film tray;
- Figure 5 is a perspective drawing of one usage of the bag.

Figure 1 shows a view of the device enabling an implementation of the process in a mammography application. The device consists of a source of x-ray radiation, not shown, with this radiation being substantially perpendicular to the plates (4, 2) in this figure. Along its path, this radiation encounters, in succession, a transparent slide (4) placed at the end of a fork (40) making it possible to exert pressure on the target (1), which consists of the body part, in this case a breast that is to be x-rayed. Beneath the

target is a bag (3a) that rests on a support plate (2) beneath which is placed the x-ray sensitive film.

As shown in Figures 2 through 4, the bag (3) is made of a closed pouch, which is in turn made of upper (30) and lower (31B, 31A) surfaces forming a closed volume accessible from the outside by two tube-shaped appendages (33, 34) located, for instance, along the continuation of the longitudinal section of the bag (3). These appendages have two valves (35, 36), the first of which (35) being used to introduce the fluid or gel to fill the bag, and the second of which (36) for emptying.

Figure 2 shows, as an example, a half-moon or rectangular-shaped bag that is more appropriate for mammography applications.

Figure 3 illustrates the surface (3) distorted by the body or the portion of the body pressed against the bag, such as in the case of the mammography shown in Figure 1. The portion of the body resting on the upper surface of the bag causes a distortion of the bag and the fluid or gel to flow into the areas where the body part is not as thick. For proper operation of the device, the bag must be partially filled and the volume of fluid or gel must be between one fourth and one half the maximum volume of the bag, preferably between one fourth and one third of the maximum volume. The inner surface of the bag, for instance (31b) shown in Figure 3, can, in certain variants, be thicker so as to provide that surface with a certain rigidity, especially when the bag is unattached and simply placed on the surface of the plate (2) facing the source of radiation while the other surface supports the x-ray sensitive film.

In another variant shown in Figure 4, the ends of the bag near the endpieces (33, 34) will be held in place by studs (20) that are secured to the film support plate (2) by any means known to specialists in the field.

A third possibility consists in making the lower surface (31a) one with the upper surface of the plate (2) by any means, such as gluing or welding. In this case, the plate (2) may itself form a portion of the pouch and only a sheet will be welded to the plate in order to form the upper portion of the pouch (30).

When the bag needs to be used in applications requiring a vertical position, such as shown in Figure 5, a bag of type (3b) may preferably be used, with said bag being filled with a fluid or gel having a high viscosity, for example between 10,000 and 100,000 centipoises and preferably in the vicinity of 50,000 centipoises. The gel may, for example, be an ultrasound gel marketed by Ondes et Rayons Rochegars S.A. under the name of Sonecho. The pouch of the bag may be made of any distortable material considered transparent to radiation, such as an elastomer, rubber, etc.

Lastly, in a final variant, a second bag may be fastened to the transparent pane (4). This second bag is preferably filled with air so as not to affect the passing of radiation; the purpose of this bag is to improve comfort and the pressure applied to the body part. This is particularly important in the case of a mammography for the patient's comfort and even distribution of pressure against the breast.

In other applications, such as in x-rays of the spinal column, the table or plate against which the patient rests his/her back will be provided with a bag of the invention that can be secured to or made one with said plate by any known means, so that the gel or fluid contained in the bag can distribute itself and make for consistent contrast, for example between the upper spinal column and the lower spinal column, and thus improve the clarity of the x-ray image in this area.

Using the process and device of the invention applied to mammomgraphy, we have found a noticeable improvement in image clarity, better definition of the deep mammary gland thanks to better compression and filtration of the scattered radiation emitted by the gland, and better visibility of the cutaneous and subcutaneous regions.

Other modifications available to specialists in the field also fall within the scope of the invention.